



- ☐ Tentative Specification
☐ Preliminary Specification
☒ Approval Specification

MODEL NO.: V546H1

SUFFIX: LH1

Customer:

APPROVED BY

SIGNATURE

Name / Title

Note

Please return 1 copy for your confirmation with your signature and comments.

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**REVISION HISTORY**

Version	Date	Page (New)	Section	Description
2.2	2010/07/22	29	8.1	Update module label



1. GENERAL DESCRIPTION

1.1 OVERVIEW

V546H1-LH1 is a 54.6" TFT Liquid Crystal Display module with 22-CCFL Backlight unit and 2-ch LVDS interface. This module supports 1920 x 1080 HDTV format and can display true 1.07G colors (10bit/color).

The inverter module for backlight is built-in.

1.2 FEATURES

- High brightness (500nits)
- High contrast ratio (4000:1)
- Fast response time (Gray to Gray average 4.5ms)
- High color saturation (72% NTSC)
- Full HDTV (1920 x 1080 pixels) resolution, true HDTV format
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Optimized response time for 120 Hz frame rate
- Ultra wide viewing angle: Super MVA technology

1.3 APPLICATION

- Standard Living Room TVs.
- Public Display Application.
- Home Theater Application.
- MFM Application.

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	1209.6 (H) x 680.4 (V) (55" diagonal)	mm	(1)
Bezel Opening Area	1267.6 (H) x 738.4 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1920x R.G.B. x 1080	pixel	-
Pixel Pitch(Sub Pixel)	0.21(H) x 0.63(V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	1.073G	color	-
Display Operation Mode	Transmissive mode / Normally black	-	-
Surface Treatment	Anti-Glare coating (Super Clear) Hardness (3H)	-	(2)

Note (1) Please refer to the attached drawings in chapter 9 for more information about the front and back outlines.

Note (2) The spec of the surface treatment is temporary for this phase. CMI reserves the rights to change this feature.

1.5 MECHANICAL SPECIFICATIONS

	Item	Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	1266.1	1267.6	1269.1	Mm	(1), (2)
	Vertical (V)	737.2	738.4	739.6	Mm	
	Depth (D)	38.5	40	41.5	Mm	
	Weight	-	19853	-	G	-

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) Module Depth does not include connectors.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	50	°C	(1), (2)
Shock (Non-Operating)	S _{NOP}	X, Y axis	40	G	(3), (5)
		Z axis	30	G	(3), (5)
Vibration (Non-Operating)	V _{NOP}	-	1.0	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ($T_a \leq 40\text{ }^{\circ}\text{C}$).

(b) Wet-bulb temperature should be 39 °C Max. ($T_a > 40\text{ }^{\circ}\text{C}$).

(c) No condensation.

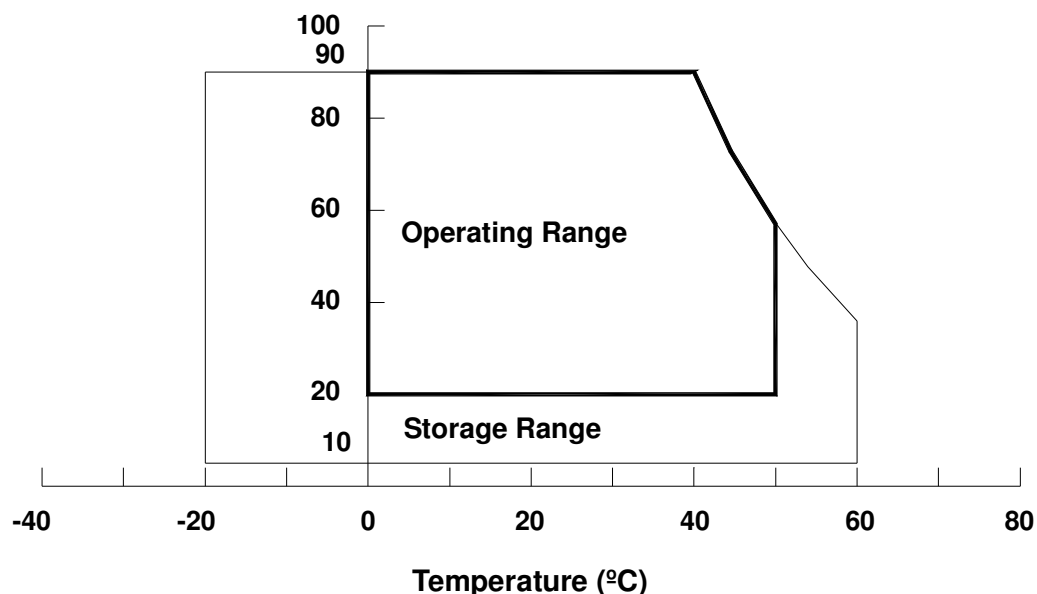
Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65 °C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in your product design to prevent the surface temperature of display area from being over 65 °C. The range of operating temperature may degrade in case of improper thermal management in your product design.

Note (3) 11 ms, half sine wave, 1 time for $\pm X$, $\pm Y$, and $\pm Z$.

Note (4) 10 ~ 200 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture. The module would not be twisted or bent by the fixture.

Relative Humidity (%RH)





2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V_{CC}	-0.3	13.5	V	(1)
Logic Input Voltage	V_{IN}	-0.3	3.6	V	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

2.2.2 BACKLIGHT INVERTER UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_W	—	3000	V_{RMS}	
Power Supply Voltage	V_{BL}	0	30	V	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under normal operating conditions.

Note (2) No moisture condensation or freezing.

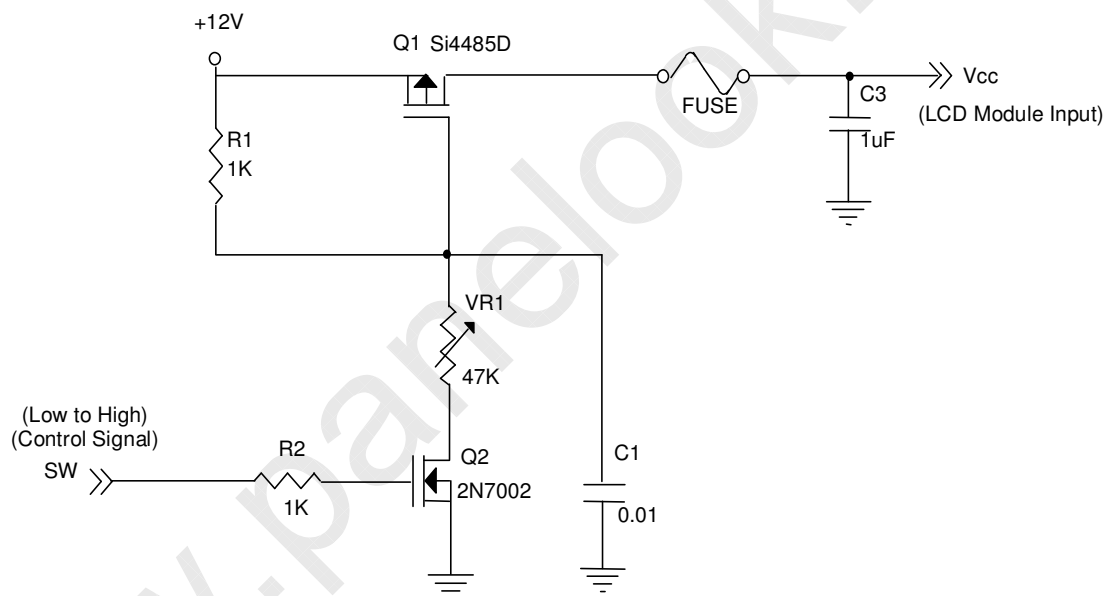
3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE ($T_a = 25 \pm 2\text{ }^{\circ}\text{C}$)

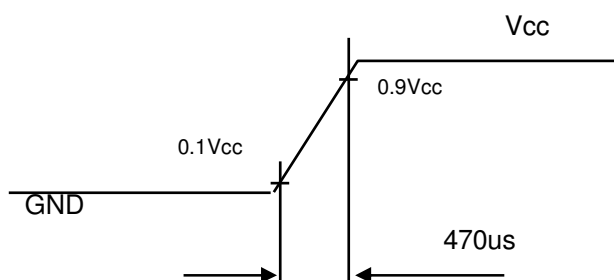
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	10.8	12	13.2	V	(1)
Rush Current		I_{RUSH}	-	-	5.2	A	(2)
Power Supply Current	White	I_{CC}	-	1.7	-	A	(3)
	Black		-	1.7	-	A	
	Vertical Stripe		-	2.6	3.1	A	
LVDS Interface	Common Input Voltage	V_{LVC}	1.125	1.25	1.375	V	
	Terminating Resistor	R_T	-	100	-	ohm	
CMOS interface	Input High Threshold Voltage	V_{IH}	2.7	-	3.3	V	
	Input Low Threshold Voltage	V_{IL}	0	-	0.7	V	

Note (1) The module should be always operated within the above ranges.

Note (2) Measurement condition:



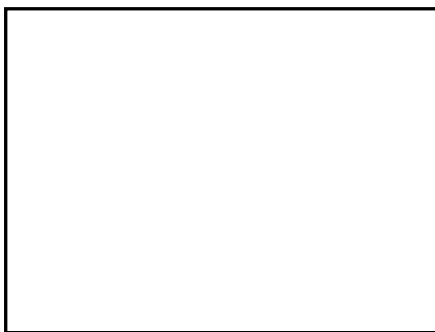
Vcc rising time is 470us



Note (3) The specified power supply current is under the conditions at $V_{CC} = 12\text{V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 60\text{Hz}$,

whereas a power dissipation check pattern below is displayed.

a. White Pattern



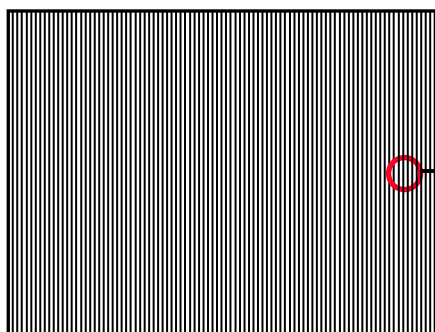
Active Area

b. Black Pattern

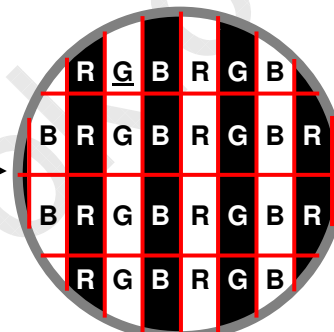


Active Area

c. Vertical Stripe Pattern



Active Area



3.2 BACKLIGHT UNIT

3.2.1 CCFL (Cold Cathode Fluorescent Lamp) CHARACTERISTICS (Ta = 25 ± 2 °C)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V _L	-	1440	-	V _{RMS}	-
Lamp Current	I _L	5.3	5.6	5.9	mA _{RMS}	(1)
Lamp Turn On Voltage	V _S	-	-	3165	V _{RMS}	(2), Ta = 0 °C
		-	-	2425	V _{RMS}	(2), Ta = 25 °C
Operating Frequency	F _L	35	55	80	KHz	(3)
Lamp Life Time	L _{BL}	50,000	-	-	Hrs	(4)

Note (1) Lamp current is measured by utilizing AC current probe and its value is average by measuring master and slave board.:

Note (2) The lamp starting voltage V_S should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may produce interference with horizontal synchronous frequency of the display input signals, and it may result in line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) The life time of a lamp is defined as when the brightness is larger than 50% of its original value and the effective discharge length is longer than 80% of its original length (Effective discharge length is defined as an area that has equal to or more than 70% brightness compared to the brightness at the center point of lamp.) as the time in which it continues to operate under the condition at Ta = 25 ± 2°C and I_L = 10.2~10.8 mA_{RMS}.

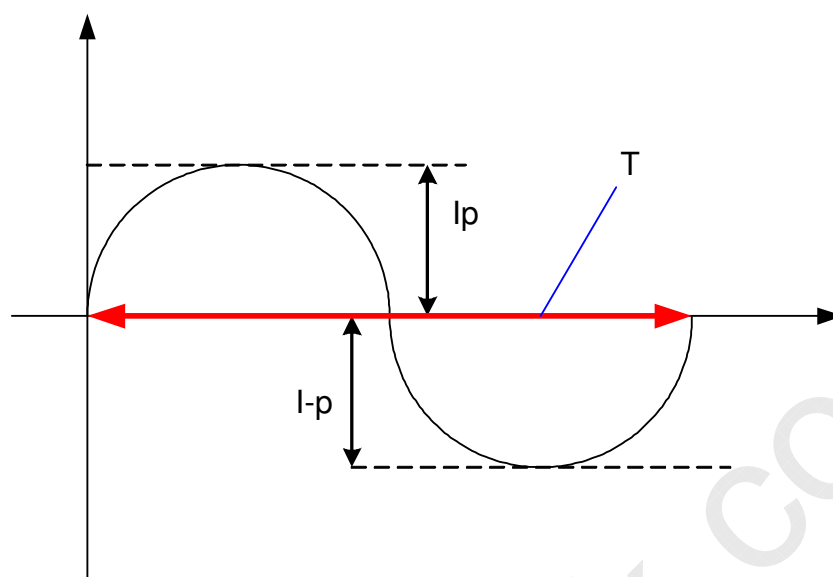
3.2.2 BALANCE BOARD CHARACTERISTICS (Ta = 25 ± 2 °C)

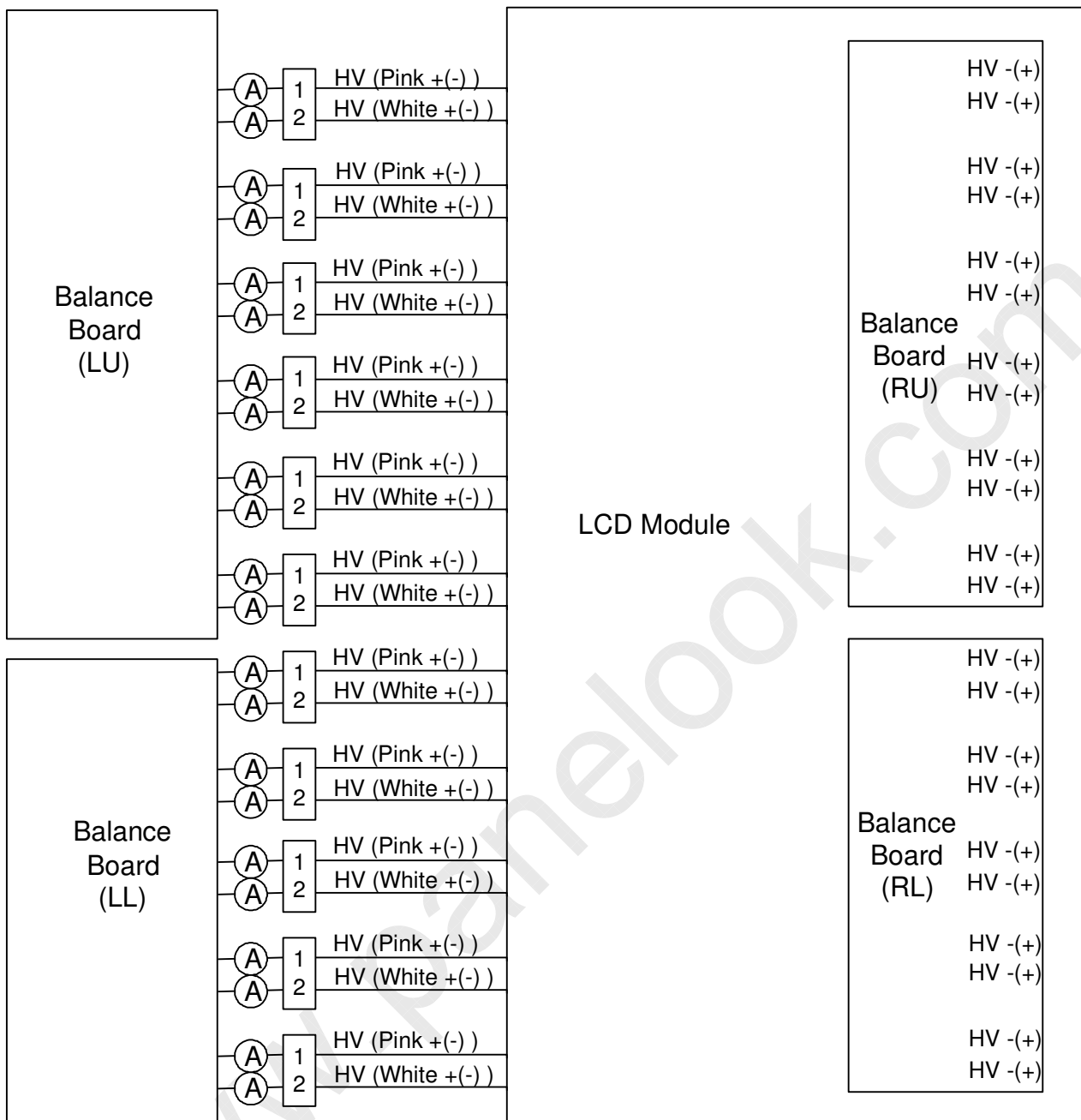
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Input High Voltage		V _{HV}	-	1440	-	V	(6)
Protection Circuit Supply Voltage		V _{CC}	10	12	15	v	
Input Current		I _{BL(HV)}		125		mA _{RMS}	No Dimming
Oscillating Frequency		F _W	45	48	51	kHz	
Individual Lamp Current		I _L	5.3	5.6	5.9	mA	H.V (5)
Lamp Detection	High (LD)	LD	5			V	Normal Operation
	Low (LD)	LD			1.5	V	Lamp Connector Open
Dimming frequency		F _B	135	150	165	Hz	
Minimum Duty Ratio		D _{MIN}	-	15	-	%	

Note (5) Lamp current is measured master board by utilizing high frequency current meters as shown below:

Note (6) Input voltage Hv based on spec. +-7% tolerance.

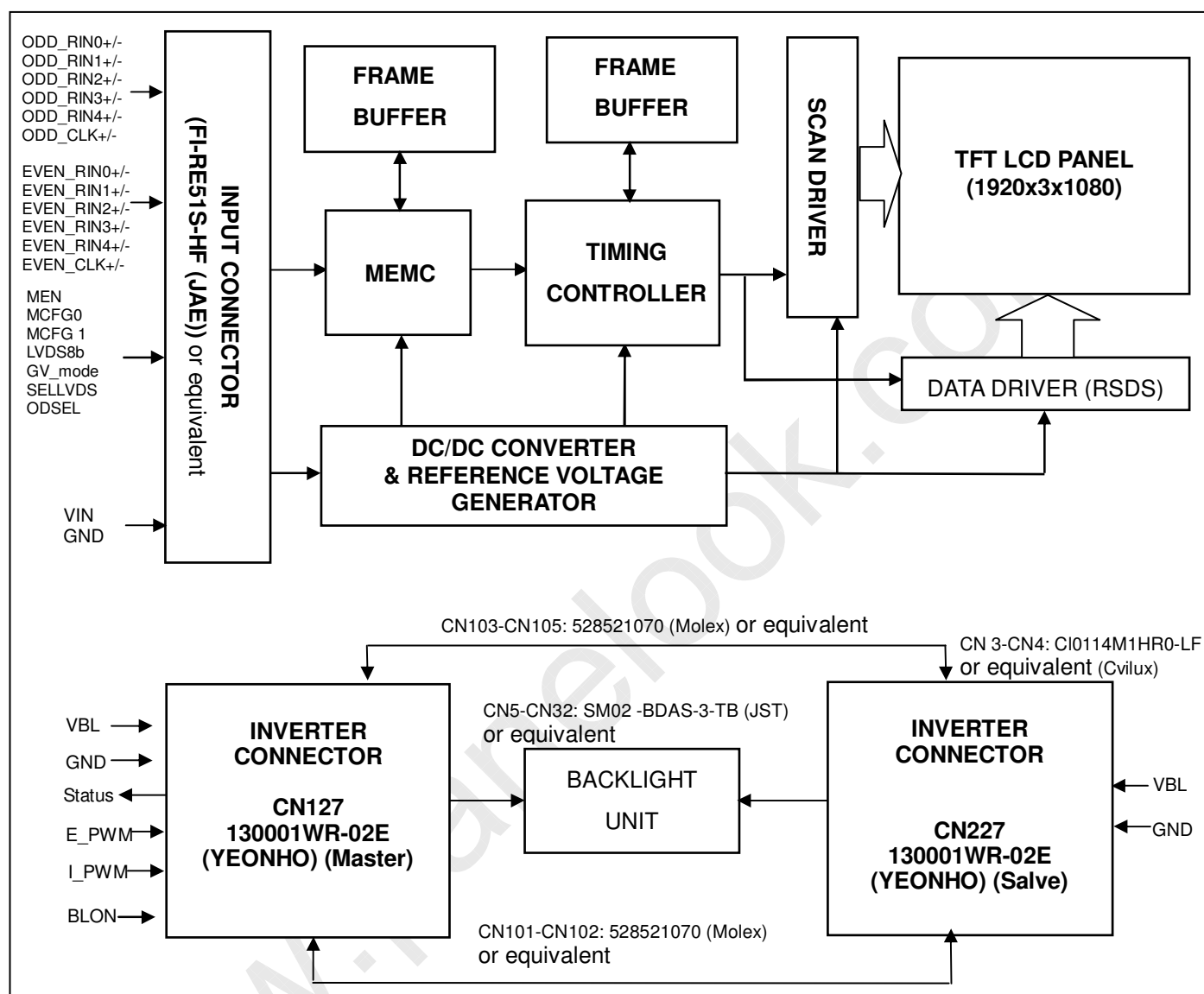
Note (7) Asymmetric ratio must be from 90% to 110% ($0.9 < I_p / I_{rms@T/2X/2} < 1.1$)





4. BLOCK DIAGRAM OF INTERFACE

4.1 TFT LCD MODULE





5 .INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD Module

CNF1 Connector Part No.: JAE Taiwan (台灣航空電子) FI-RE51S-HF or equivalent.

Pin	Name	Description	Note
1	GND	Ground	
2	MEN	MEMC function selection	4
3	MCFG0	MEMC function selection	4
4	MCFG1	MEMC function selection	4
5	LVDS8b	8bit/10bit LVDS input selection	5
6	GV_mode	Graphic / Video mode selection	6
7	SELLVDS	LVDS data format Selection	2
8	Res.	No Connection	
9	Res.	No Connection	
10	ODSEL	Overdrive Lookup Table Selection	3
11	GND	Ground	
12	ERX0-	2nd pixel Negative LVDS differential data input. Channel 0	
13	ERX0+	2nd pixel Positive LVDS differential data input. Channel 0	
14	ERX1-	2nd pixel Negative LVDS differential data input. Channel 1	
15	ERX1+	2nd pixel Positive LVDS differential data input. Channel 1	
16	ERX2-	2nd pixel Negative LVDS differential data input. Channel 2	
17	ERX2+	2nd pixel Positive LVDS differential data input. Channel 2	
18	GND	Ground	
19	ECLK-	2nd pixel Negative LVDS differential clock input.	
20	ECLK+	2nd pixel Positive LVDS differential clock input.	
21	GND	Ground	
22	ERX3-	2nd pixel Negative LVDS differential data input. Channel 3	
23	ERX3+	2nd pixel Positive LVDS differential data input. Channel 3	
24	ERX4-	2nd pixel Negative LVDS differential data input. Channel 4	
25	ERX4+	2nd pixel Positive LVDS differential data input. Channel 4	
26	N.C.	No Connection	1
27	N.C.	No Connection	1
28	ORX0-	1st pixel Negative LVDS differential data input. Channel 0	
29	ORX0+	1st pixel Positive LVDS differential data input. Channel 0	
30	ORX1-	1st pixel Negative LVDS differential data input. Channel 1	
31	ORX1+	1st pixel Positive LVDS differential data input. Channel 1	
32	ORX2-	1st pixel Negative LVDS differential data input. Channel 2	
33	ORX2+	1st pixel Positive LVDS differential data input. Channel 2	
34	GND	Ground	
35	OCLK-	1st pixel Negative LVDS differential clock input.	
36	OCLK+	1st pixel Positive LVDS differential clock input.	
37	GND	Ground	
38	ORX3-	1st pixel Negative LVDS differential data input. Channel 3	
39	ORX3+	1st pixel Positive LVDS differential data input. Channel 3	
40	ORX4-	1st pixel Negative LVDS differential data input. Channel 4	

41	ORX4+	1st pixel Positive LVDS differential data input. Channel 4	
42	N.C.	No Connection	1
43	N.C.	No Connection	1
44	GND	Ground	
45	GND	Ground	
46	GND	Ground	
47	N.C.	No Connection	
48	VCC	+12V power supply	
49	VCC	+12V power supply	
50	VCC	+12V power supply	
51	VCC	+12V power supply	

Note (1) Reserved for internal use. Please leave it open.

Note (2)

SELLVDS	Mode
L(default)	VESA
H	JEIDA

L: Connect to GND, H: Connect to +3.3V

Note (3) Overdrive lookup table selection. The overdrive lookup table should be selected in accordance with the frame rate to optimize image quality.

ODSEL	Description
L(default)	Lookup table was optimized for 60 Hz frame rate input.
H	Lookup table was optimized for 50 Hz frame rate input.

L: Connect to GND, H: Connect to +3.3V

Note (4) Motion Engine (ME) Level & Demo Function Table

Motion engine level must be adjusted after video mode is selected (or entered).

Adjusting the motion engine level in graphic mode has no effect

		MEN	MCFG1	MCFG0	Notes		
Blanking	Blanking disable	0	0	0	(a)		
	Auto blanking	0	0	1	(b)		
	Blanking enable	0	1	0	(c)		
Effect of ME →				De blur	De judder	Halo	
Demo mode (d)		0	1	1	Demo Window		
ME	Strong	1	0	0	Enable	Strong	Strong
Level	Medium(Default)	1	0	1	Enable	Normal	Normal

Weak	1	1	0	Enable	x	x
OFF	1	1	1	x	x	x
	(e) (f) (g)					

(a) Module re-starts processing video signals from Frontend scaler control board.

(b) During sync unstable period such as format change, 60Hz <-> 50Hz .

MCFG0 can be used to insert blanking of 500ms. This signal is toggled.

(c) Module continues to insert blanking until blanking disable signal is received from frontend scaler board.

(d) Demo window mode: Demo Window appears to the left half of display area. Left side with frame is 120Hz with MEMC, and right side is 120Hz w/o motion compensation.

(e) GPIO (General Purpose I/O) sequence of ME Level: (1) MEN; (2) MCFG1; (3) MCFG0.

GPIO sequence of Blanking Enable, Blanking Disable and Demo window: (1) MCFG1; (2) MCFG0; (3) MEN.

(f) Each scaler command must be maintained the same voltage level at least 100ms.

(g) 0 : Connect to GND, 1 : +3.3V

Note (5) 8bit/10bit LVDS input selection

LVDS8b	Bit depth
H(default)	8bit
L	10bit

L : Connect to GND, H : Connect to +3.3V

Note (6) Graphic / Video mode selection

There is no prohibited time period for switching between Graphic mode and Video mode.

When this switching signal is input, LCD will be reset and will re-start selected mode.

GV_mode	Mode select	MEMC ON/OFF
H(default)	Graphic mode	MEMC OFF
L	Video mode	MEMC ON

L : Connect to GND, H : Connect to +3.3V

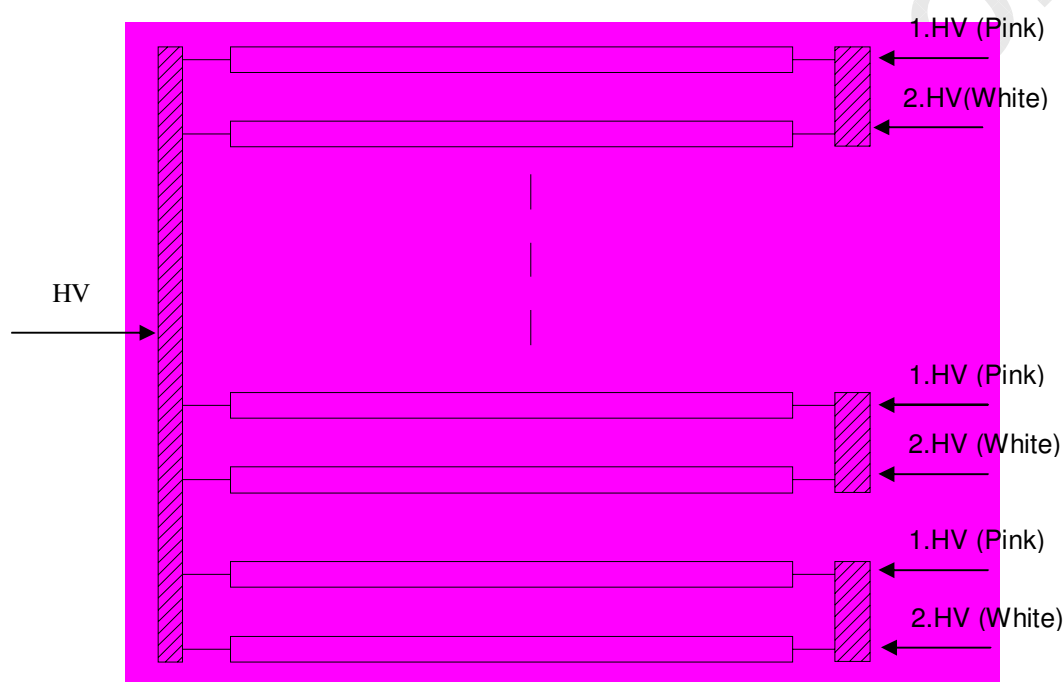
5.2 BACKLIGHT UNIT

The pin configuration for the housing and the leader wire is shown in the table below.

CN3-CN13: SM02-BDAS-3-TB (JST)

Pin	Name	Description	Wire Color
1	HV	High Voltage	Pink
2	HV	High Voltage	White

Note (1) The backlight interface housing for high voltage side is a model SM02-BDAS-3-TB, manufactured by JST. The mating header on inverter part number is



**5.3 BALANCE BOARD UNIT**

CN1 (Header) (RU & RL): SM02-BDAS-3-TB (JST)

Pin No.	Symbol	Description
1	HV+(-)	High Voltage Input
2	HV+(-)	High Voltage Input

CN2 (Header) (Master): SM02-BDAS-3-TB (JST)

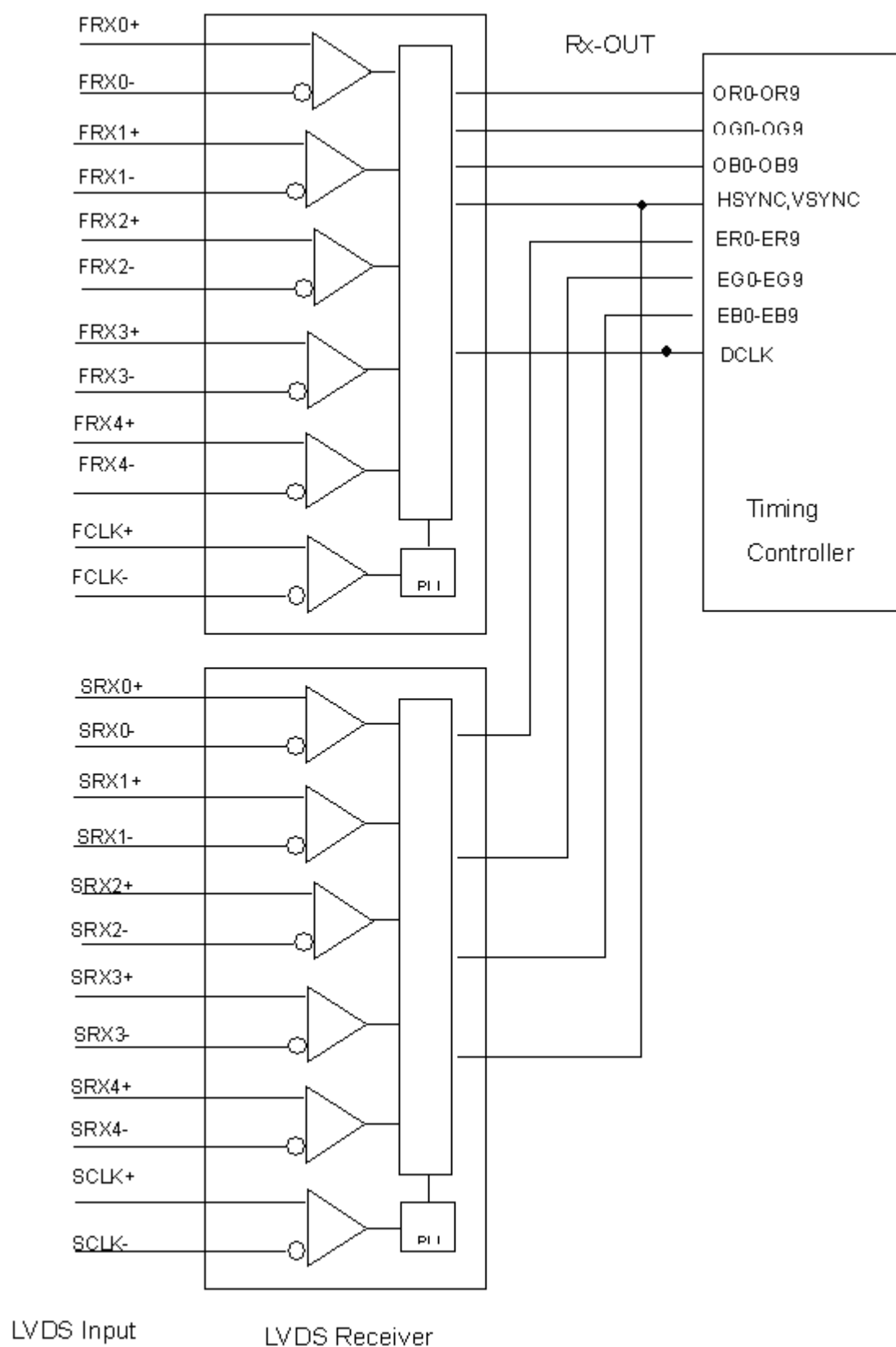
Pin No.	Symbol	Description
1	HV-(+)	High Voltage Input
2	HV-(+)	High Voltage Input

CN3-CN13 (Header) (RU & RL): SM02-BDAS-3-TB (JST)

Pin No.	Symbol	Description
1	CCFL HOT	CCFL High voltage
2	CCFL HOT	CCFL High voltage

CN33 (Header): KN30-7P-1.25H (Hirose).

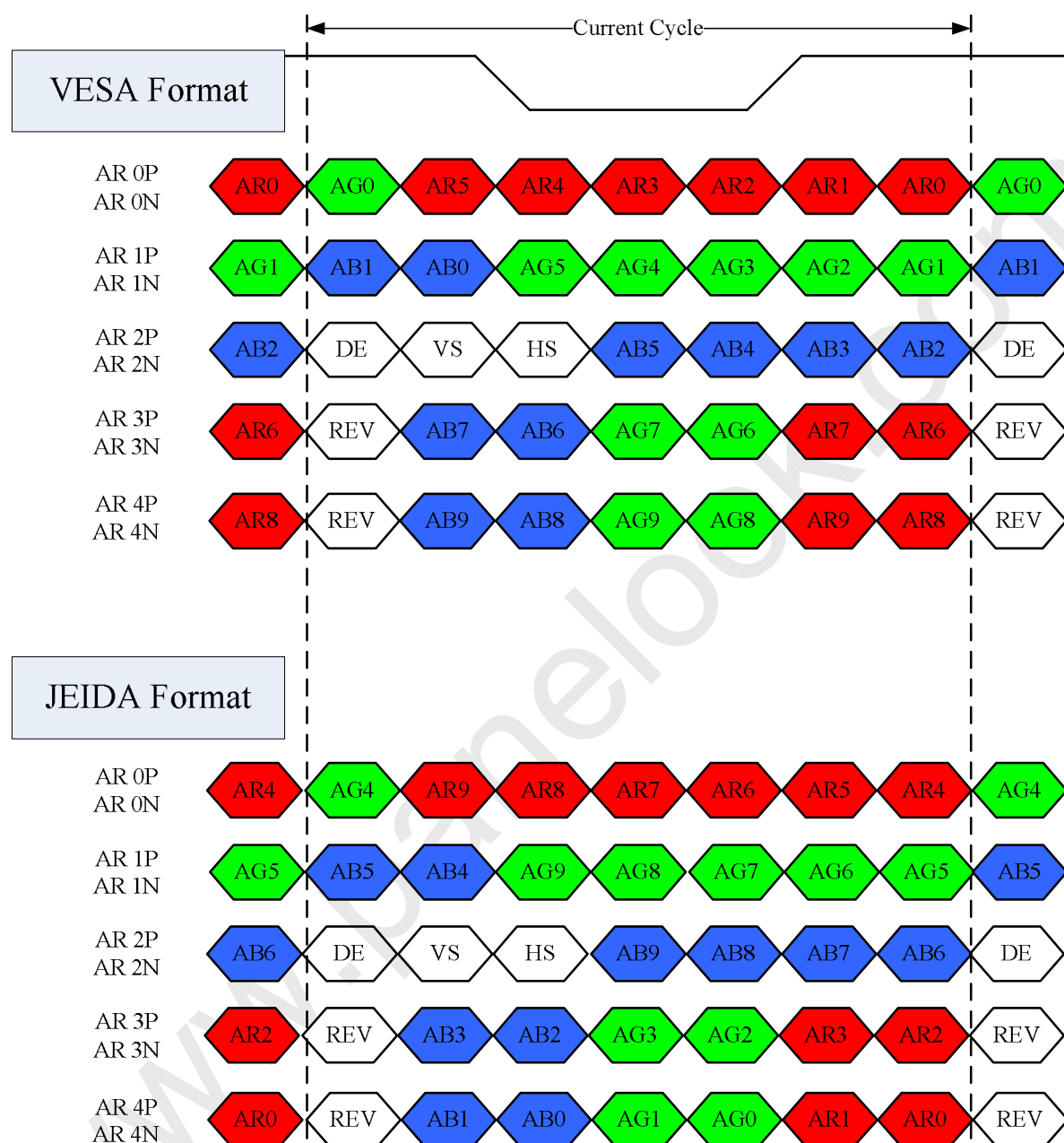
Pin No.	Symbol	Description
1	VCC	Power Supply for Protection Circuit
2	FB1	Lamp Current Feedback 1
3	FB2	Lamp Current Feedback 2
4	GND	Signal Ground
5	GND	Signal Ground
6	LD	CCFL Connector Open & Non-lighting signal
7	LD	CCFL Connector Open & Non-lighting signal

5.4 BLOCK DIAGRAM OF INTERFACE


5.5 LVDS INTERFACE

VESA Format : SELLVDS = H or Open

JEIDA Format : SELLVDS = L



AR0~AR9: First Pixel R Data (9; MSB, 0; LSB)

AG0~AG9: First Pixel G Data (9; MSB, 0; LSB)

AB0~AB9: First Pixel B Data (9; MSB, 0; LSB)

DE : Data enable signal

DCLK : Data clock signal

RSVD : Reserved



5.6 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 10-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																									
		Red										Green										Blue					
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1)	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (2)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	Red (1021)	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1022)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Red (1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	Green (1021)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0
Gray Scale Of Blue	Green (1022)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green (1023)	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
	Blue (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue (1021)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0
	Blue (1022)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0
	Blue (1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

**6. INTERFACE TIMING****6.1 INPUT SIGNAL TIMING SPECIFICATIONS**

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	1/Tc	60	74.25	78	MHz	-
	Input cycle to cycle jitter	Trcl	-	-	200	ps	-
LVDS Receiver Data	Setup Time	Tlvsu	600	-	-	ps	-
	Hold Time	Tlvhd	600	-	-	ps	-
Vertical Active Display Term	Frame Rate		57	60	61	Hz	-
			47	50	53		
	Total	Tv	1115	1125	1135	Th	Tv=Tvd+Tvb
	Display	Tvd	1080	1080	1080	Th	-
	Blank	Tvb	35	45	55	Th	-
Horizontal Active Display Term	Total	Th	1050	1100	1150	Tc	Th=Thd+Thb
	Display	Thd	960	960	960	Tc	-
	Blank	Thb	90	140	190	Tc	-

**6.2 INTERNAL SIGNAL TIMING SPECIFICATIONS (FRC→ T-CON)**

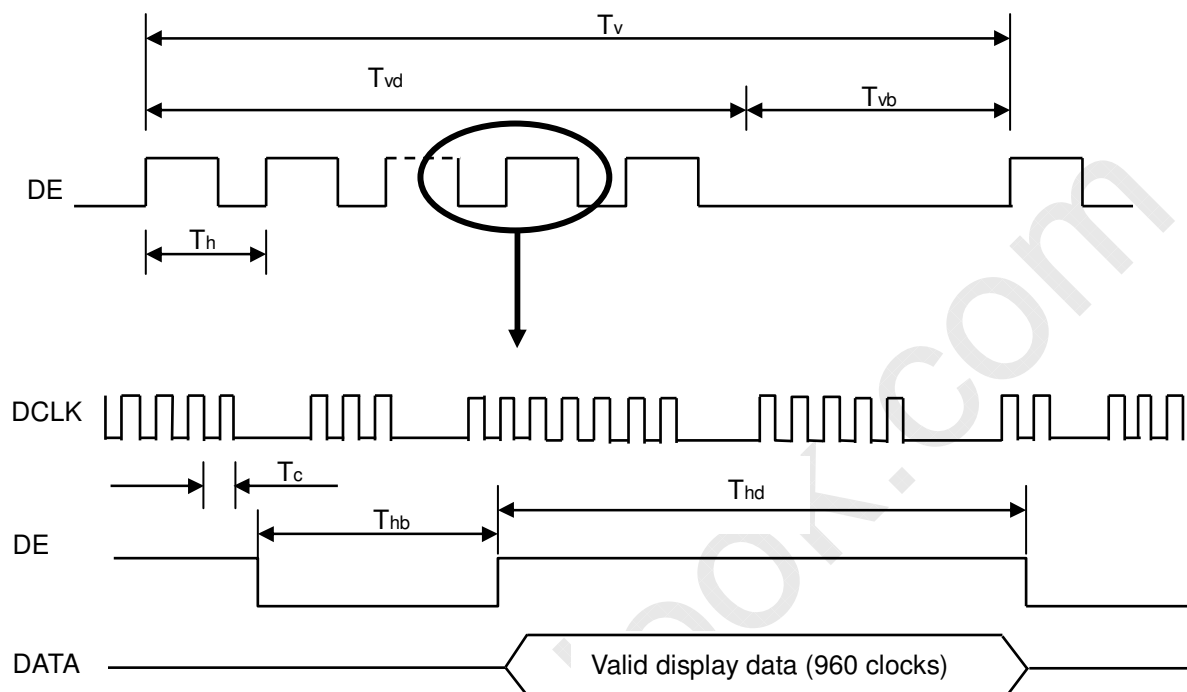
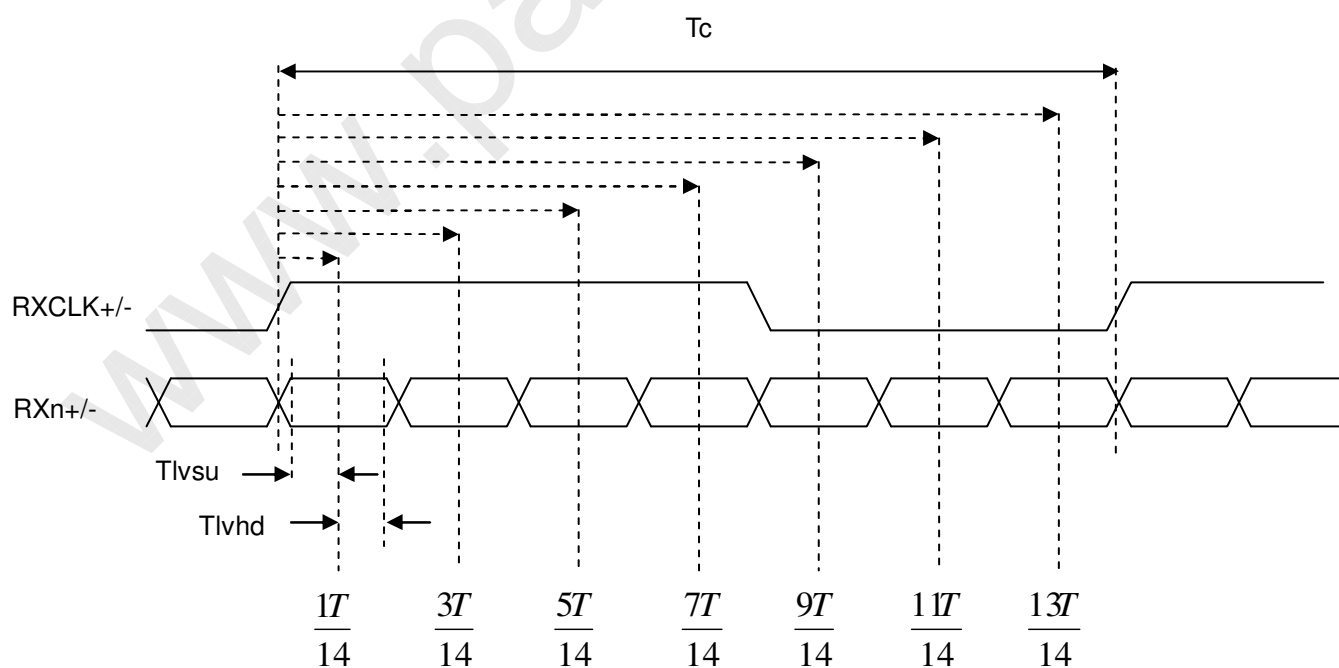
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	1/Tc	60	74.25	78	MHz	-
	Input cycle to cycle jitter	Trcl	-	-	200	ps	-
LVDS Receiver Data	Setup Time	Tlvsu	600	-	-	ps	-
	Hold Time	Tlvhd	600	-	-	ps	-
Vertical Active Display Term	Frame Rate		57	60	61	Hz	-
			47	50	53		
	Total	Tv	1115	1125	1135	Th	Tv=Tvd+Tvb
	Display	Tvd	1080	1080	1080	Th	-
	Blank	Tvb	35	45	55	Th	-
Horizontal Active Display Term	Total	Th	1050	1100	1150	Tc	Th=Thd+Thb
	Display	Thd	960	960	960	Tc	-
	Blank	Thb	90	140	190	Tc	-

Note : Since the module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would operate abnormally.

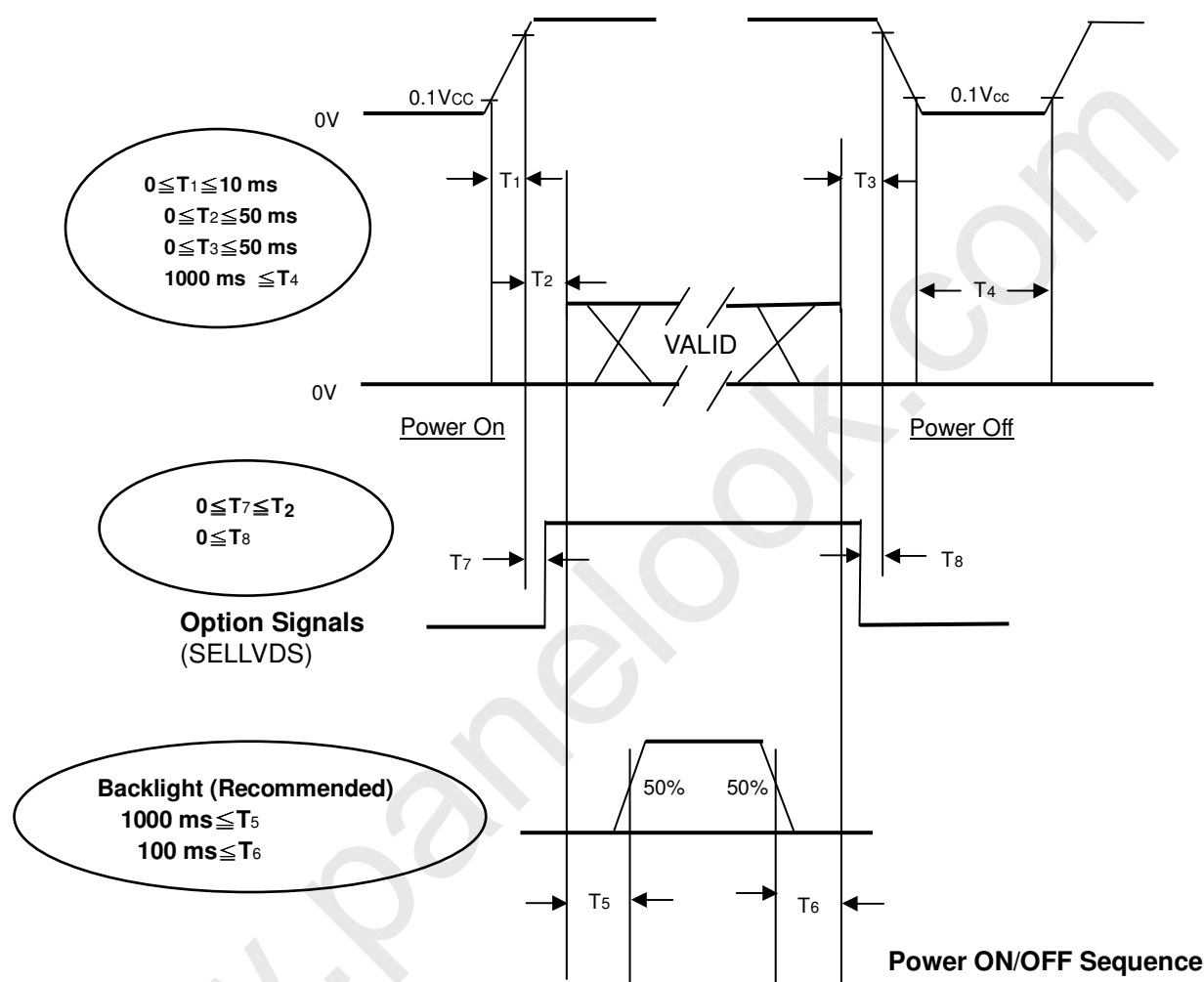
Note(1) : LVDS Clock should not over 80MHz even if H-total or V-total is in spec, and the frequency follows the equation below.

$$\text{LVDS CLK} = \text{Frame rate} * \text{H-total} * \text{V-total}$$

INPUT SIGNAL TIMING DIAGRAM**LVDS RECEIVER INTERFACE TIMING DIAGRAM**

6.3 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the diagram below.



Note :

- (1) The supply voltage of the external system for the module input should follow the definition of Vcc.
- (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.
- (3) In case of VCC is in off level, please keep the level of input signals on the low or high impedance.
- (4) T4 should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.



7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	12V	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current	I _L	5.6±0.3	mA
Oscillating Frequency (Inverter)	F _w	48±3	KHz
Vertical Frame Rate	Fr	120	Hz

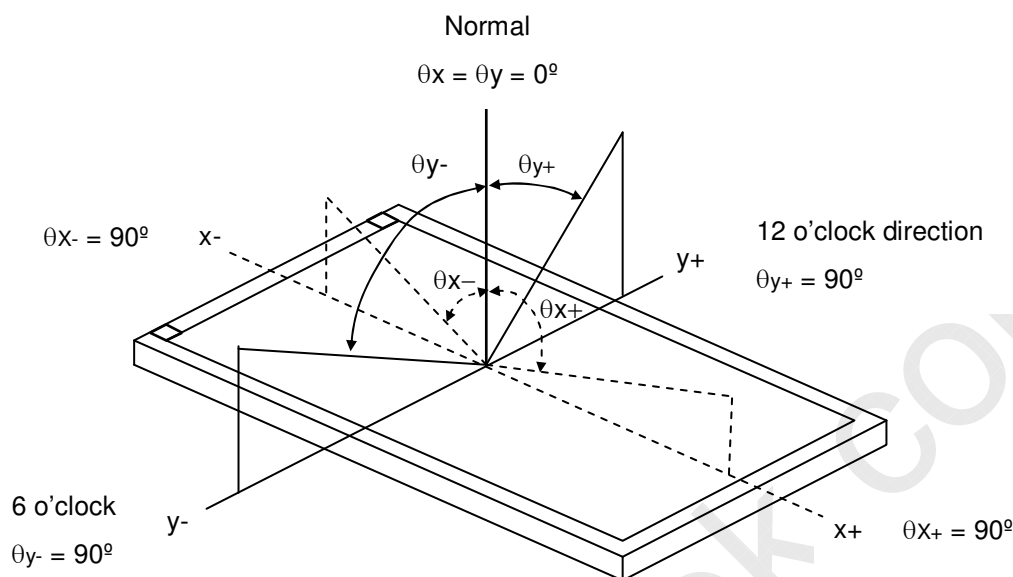
7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing angle at normal direction	(3000)	(4000)	-	-	Note (2)
Response Time		Gray to gray		-	(4.5)	12	ms	Note (3)
Center Luminance of White		L _C		450	500	-	cd/m ²	Note (4)
White Variation		δW		-	-	1.3	-	Note (7)
Cross Talk		CT		-	-	4	%	Note (5)
Color Chromaticity	Red	R _x		Typ.- 0.03	0.643	Typ.+ 0.03	-	Note (6)
		R _y			0.326		-	
	Green	G _x			0.293		-	
		G _y			0.599		-	
	Blue	B _x			0.150		-	
		B _y			0.061		-	
	White	W _x			0.280		-	
		W _y			0.290		-	
	Color Gamut					72	-	%
Viewing Angle	Horizontal	θ _{x+}	CR≥20	80	88	-	Deg.	Note (1)
		θ _{x-}		80	88	-		
	Vertical	θ _{y+}		80	88	-		
		θ _{y-}		80	88	-		

Note (1) Definition of Viewing Angle (θ_x , θ_y):

Viewing angles are measured by Autronic Conoscope Cono-80



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

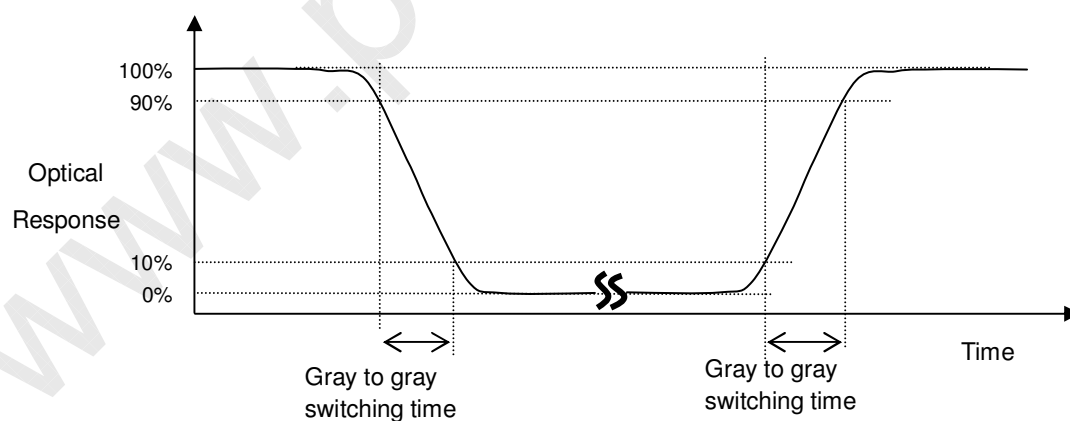
$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

L_{255} : Luminance of gray level 255

L_0 : Luminance of gray level 0

$CR = CR(5)$, where $CR(X)$ is corresponding to the Contrast Ratio of the point X at the figure in Note (7)

Note (3) Definition of Gray to Gray Switching Time :



The driving signal means the signal of gray level 0, 63, 127, 191, and 255.

Gray to gray average time means the average switching time of gray level 0, 63, 127, 191, 255 to each other .

Note (4) Definition of Luminance of White (L_c):

Measure the luminance of gray level 255 at center point.

$L_C = L(5)$, where $L(x)$ is corresponding to the luminance of the point X at the figure in Note (7).

Note (5) Definition of Cross Talk (CT):

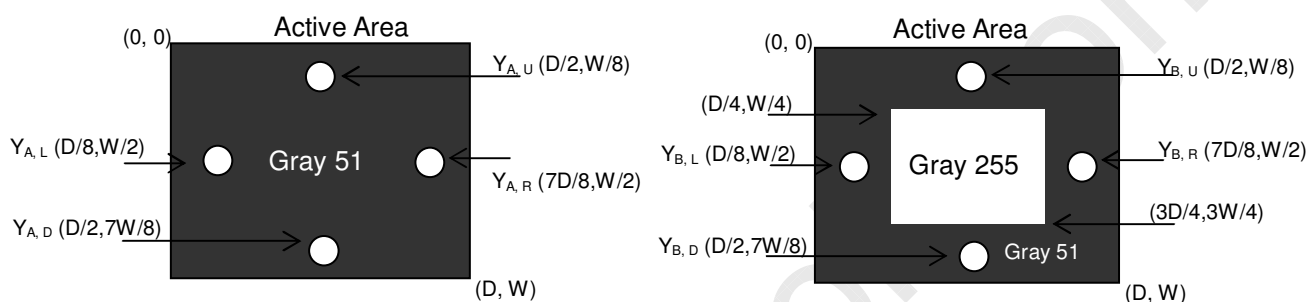
$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where:

(a)

Y_A = Luminance of measured location without gray level 255 pattern (cd/m^2)

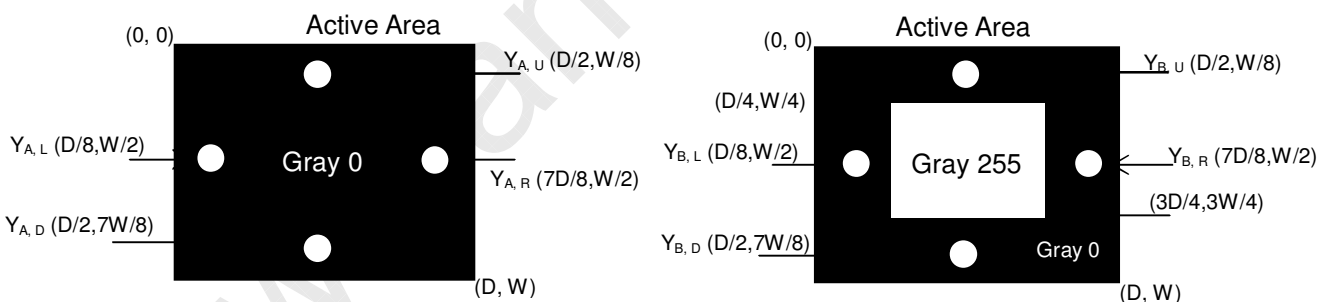
Y_B = Luminance of measured location with gray level 255 pattern (cd/m^2)



(b)

Y_A = Luminance of measured location without gray level 255 pattern (cd/m^2)

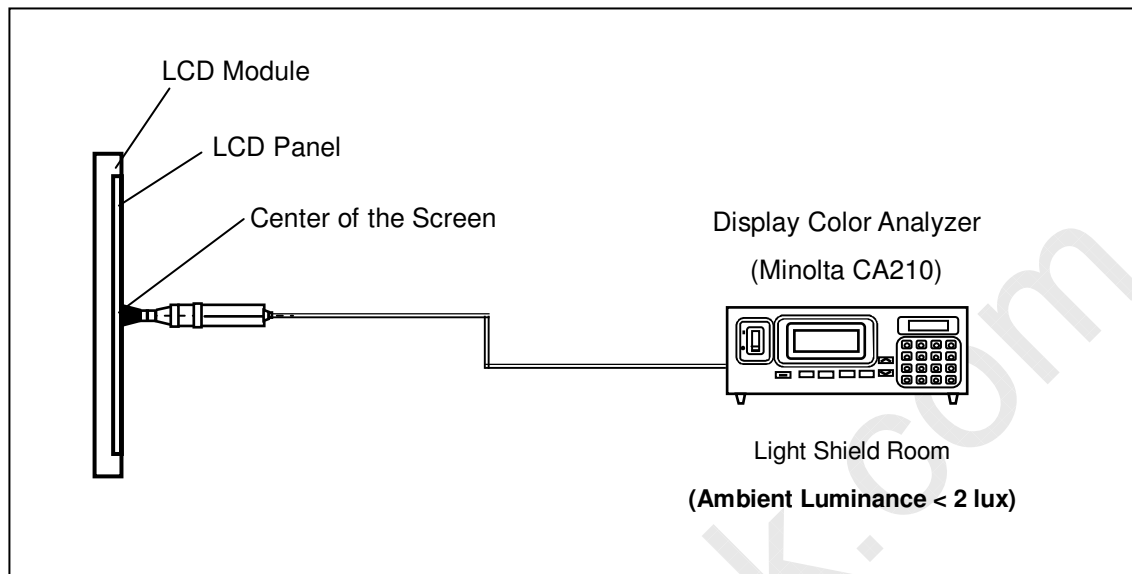
Y_B = Luminance of measured location with gray level 255 pattern (cd/m^2)



Note (6) Measurement Setup:

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature

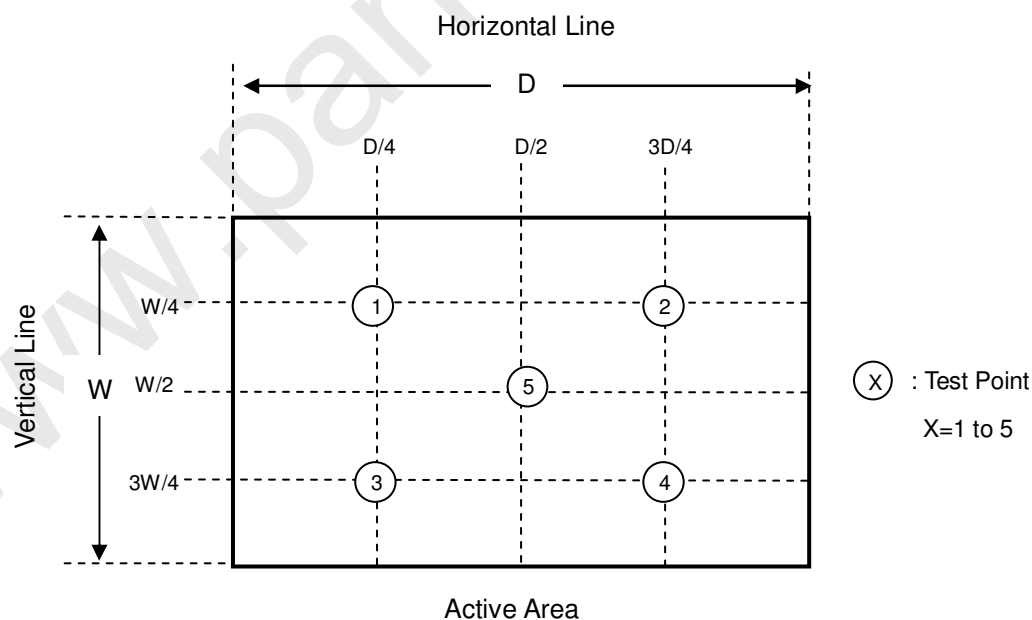
change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 1 hour in a windless room.



Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

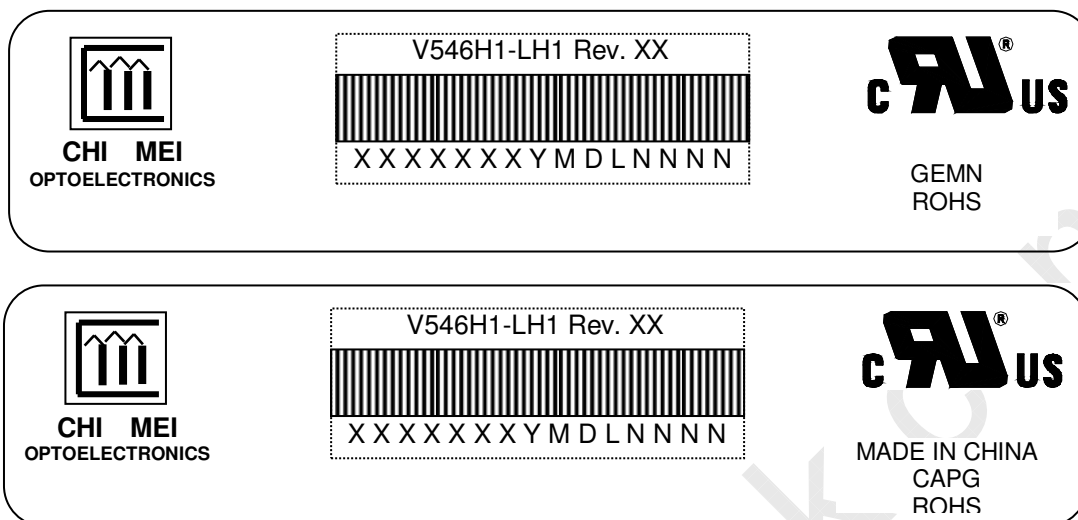
$$\delta W = \text{Maximum} [L(1), L(2), L(3), L(4), L(5)] / \text{Minimum} [L(1), L(2), L(3), L(4), L(5)]$$



8. DEFINITION OF LABELS

8.1 CMI MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: V546H1-LH1
- (b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.
- (c) CMI barcode definition:

Serial ID: XX-XX-X-XX-YMD-L-NNNN

Code	Meaning	Description
XX	CMI internal use	-
XX	Revision	Cover all the change
X-XX	CMI internal use	-
YMD	Year, month, day	Year: 2001=1, 2002=2, 2003=3, 2004=4....2010=0,2011=1,2012=2.... Month: Jan. ~ Dec.=1, 2, 3, ~, 9, A, B, C Day: 1 st to 31 st =1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U
L	Product line #	Line 1=1, Line 2=2, Line 3=3, ...
NNNN	Serial number	Manufacturing sequence of product

9. PACKAGING

9.1 PACKING SPECIFICATIONS

- (1) 2 LCD TV modules / 1 Box
- (2) Box dimensions: 1334(L) X 284 (W) X 856 (H)
- (3) Weight: approximately 46 Kg (2 modules per box)

9.2 PACKING METHOD

Figures 9-1 and 9-2 are the packing method

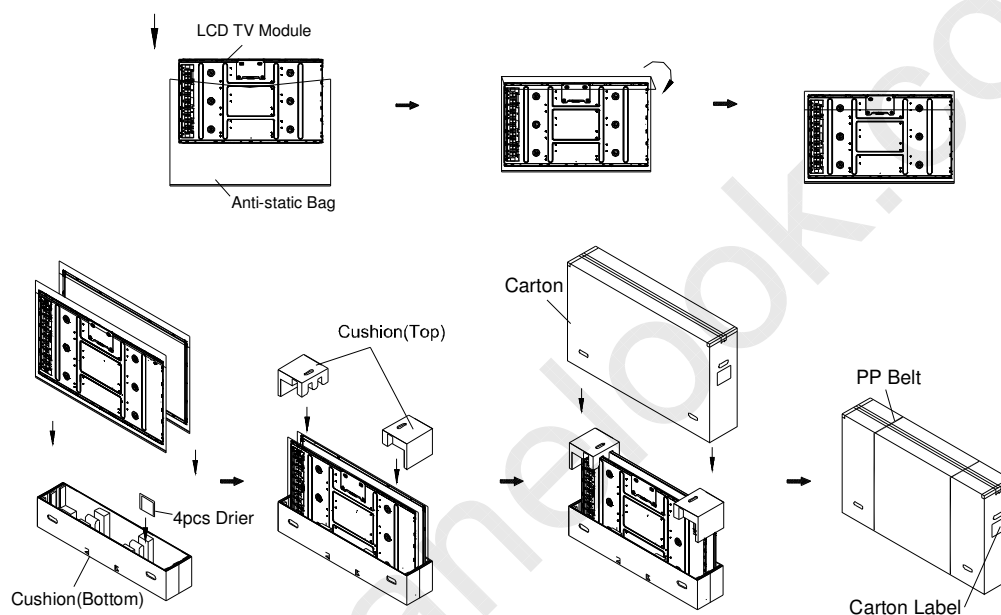
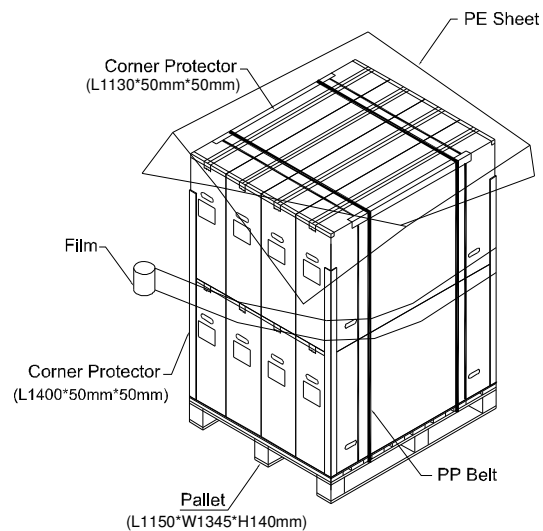
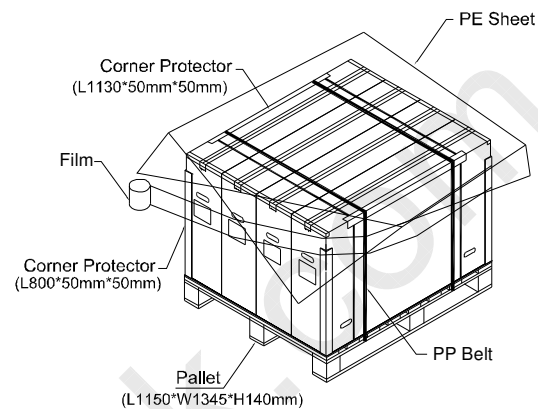


Figure.9-1 packing method

**Sea & Land Transportation**
Gross : 383Kg**Air Transportation**
Gross : 199Kg



10. PRECAUTIONS

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and backlight.
- (4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.
- (10) When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

10.2 SAFETY PRECAUTIONS

- (1) The startup voltage of a backlight is over 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

10.3 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:

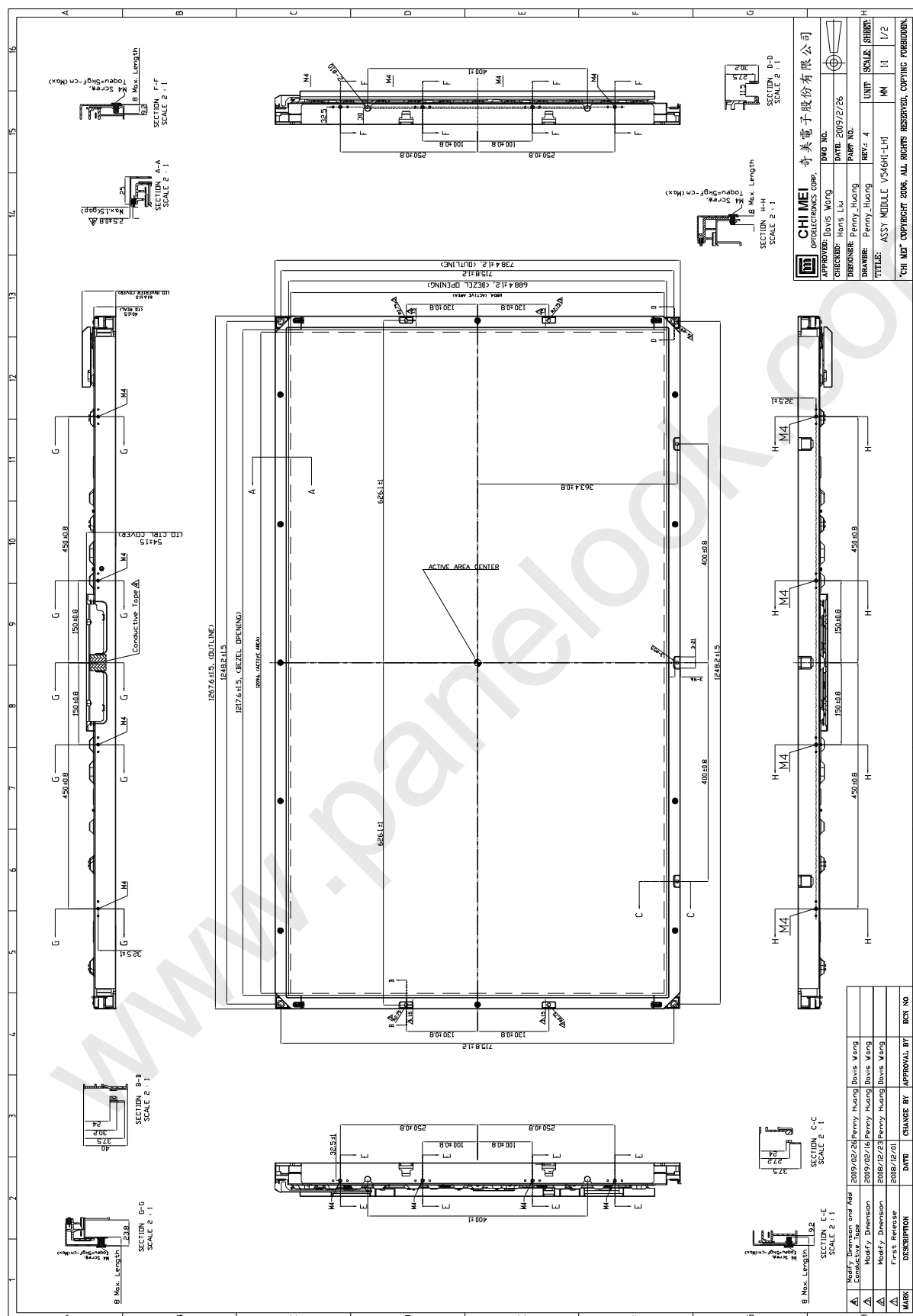
Regulatory	Item	Standard
Information Technology equipment	UL	UL 60950-1: 2003
	cUL	CAN/CSA C22.2 No.60950-1-03
	CB	IEC 60950-1:2001
Audio/Video Apparatus	UL	UL 60065: 2003

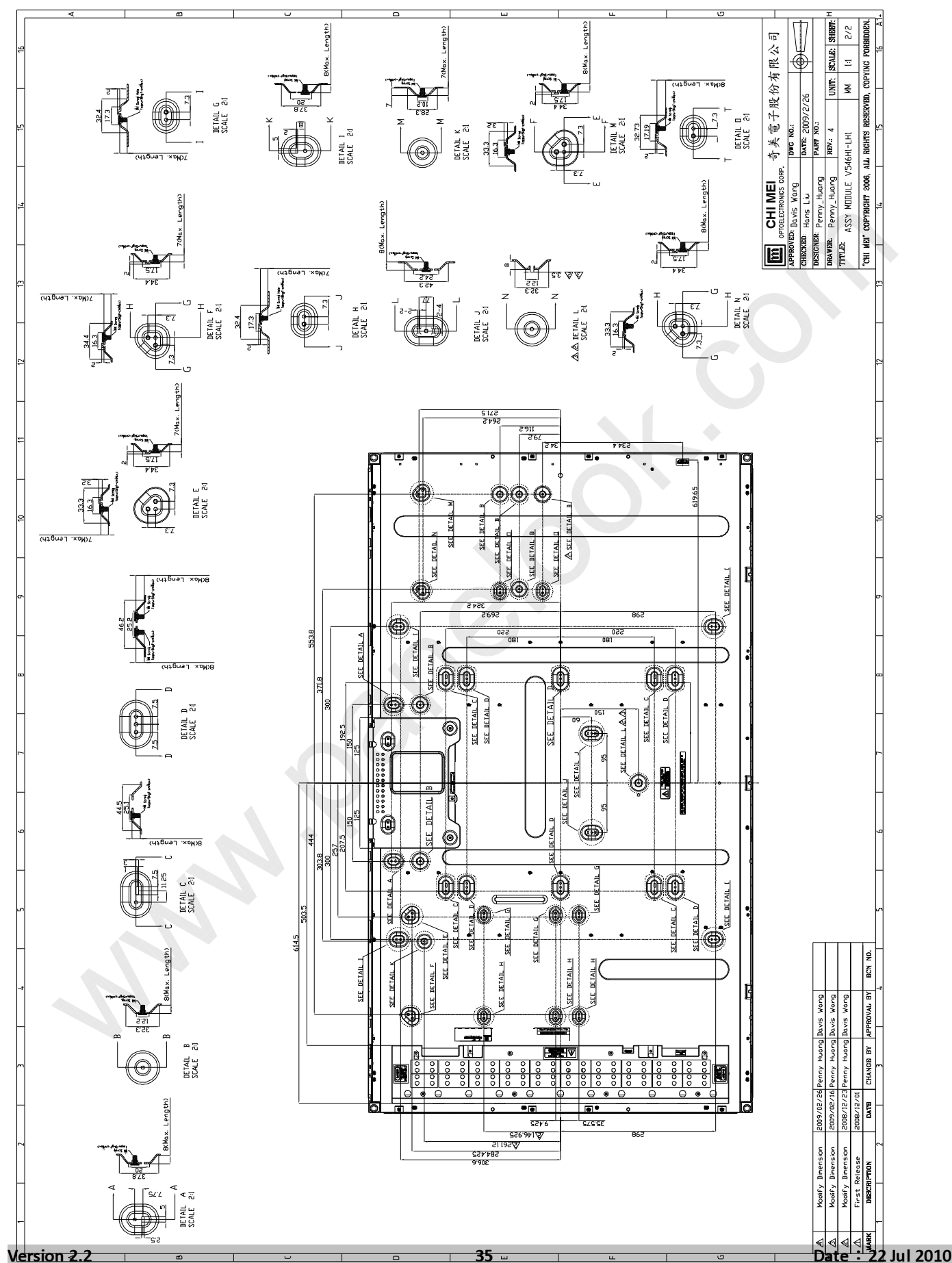


	cUL	CAN/CSA C22.2 No.60065-03
	CB	IEC 60065:2001

If the module displays the same pattern for a long period of time, the phenomenon of image sticking may be occurred.

11. MECHANICAL CHARACTERIST







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